MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2017/2018

BEM1034 – MATHEMATICS FOR ECONOMICS
(All sections / Groups)

1 JUNE 2018
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 5 pages excluding the cover page.

2. Answer ALL questions. The distribution of the marks are given for all questions.

3. Write all your answers in the Answer Booklet provided.

4. Selected mathematical formula are provided at the end of the question paper.

Question 1

(a) Solve for x: $\log_2(2x+3) = (2\log_2 x) + 3$ (6 marks)

(b) The purchasing power P (in Ringgit Malaysia) of an annual pension amount of A (in RM) after t years of k percent inflation decays according to the following function:

$$P = Ae^{-kt}$$

  i)   Find k if the pension of RM 120,000 per year has a purchasing power of RM 60,000 after 10 years. Leave your answer in 3 decimal places.

                    (5 marks)

  ii) Using the k obtained above, how much pension would be needed so the purchasing power is RM 100,000 after 15 years?

                    (2 marks)

(c) Solve the following system of linear equations using the inverse matrix.

$$4x_1 + x_2 - 5x_3 = 8$$
$$-2x_1 + 3x_2 + x_3 = 12$$
$$3x_1 - x_2 + 4x_3 = 5$$

                    (12 marks)

[Total: 25 Marks]

Question 2

(a) Consider an open economy with three industries: coal-mining operation (X), electricity-generating plant (Y) and an auto-manufacturing plant (Z). The input-output matrix is given as follows:

$$\begin{array}{ccc} X & Y & Z \end{array}$$
$$\mathbf{A} = \begin{bmatrix} 0.1 & 0.4 & 0.5 \\ 0.1 & 0.3 & 0.2 \\ 0.6 & 0.1 & 0.4 \end{bmatrix}$$

If the economy has external demand of $120 thousand worth of coal, $90 thousand worth of electricity and $70 thousand worth of autos, find the level of production of each of the industries. Leave your final answers in two decimal places.

(16 marks)

(b) Determine if the function $f(x) = \dfrac{5}{x-7}$ is continuous at $x = 6$. (6 marks)

(c) Find the values where the function $g(x) = \dfrac{2 - x - x^2}{15 - 2x - x^2}$ is discontinuous.
You do not need to prove its discontinuity.

(3 marks)

[Total: 25 Marks]

Continued...

Question 3

(a) Find the derivative for each function below:

i) $y = 5x^4 e^{2x} + 3x \ln x$ (6 marks)

ii) $y = \dfrac{1-t^2}{t^3} - 2t + 7$ (5 marks)

(b) The quantity of digital cameras demanded each week, q (in units of hundred), is related to the unit price in Ringgit Malaysia, p, by the following demand equation:

$$q = \frac{2}{3}\left(40 - p^2\right)^{\frac{1}{2}} \quad \text{for } 0 \le p \le \sqrt{40}$$

If $p = 2$, is the demand elastic or inelastic? Show your calculations.

(7 marks)

(c) Use the implicit function rule to find $\dfrac{dy}{dz}$ and $\dfrac{dy}{dx}$ for $f(x,y,z) = 2ye^x + xz^2 - x^2yz$.

(7 marks)

[Total: 25 Marks]

Continued...

Question 4

(a) The demand function for a certain item is given by

$$p = -0.01x^2 - 0.5x + 13$$

where p is the wholesale unit price in Ringgit Malaysia and x is the quantity demanded each day, measured in units of a hundred. Determine the consumers' surplus if the wholesale market price is set at RM 7 per item.

(7 marks)

(b) Solve the following differential equation by separation of variables:

$$x^3\left(y^2 - 3\right)\frac{dy}{dx} = y^4\left(x - 4\right)$$

(7 marks)

(c) Consider the following differential equation:

$$\frac{dy}{dx} = -\frac{y + y^2}{x + 2xy}$$

Determine if the differential equation is exact. If it is exact, solve it.

(11 marks)

[Total: 25 Marks]

End of Page.

Formula

1. **Input-Output Model**

   $(I - A)X = D$

   where A is the input-output matrix, D is the external or final demand and X is the production level.

2. **Total differential (change)**

   If $z = f(x, y)$, then the total change is $dz = f_x dx + f_y dy$.

3. **Implicit function rule**

   For a function $f(x_1, x_2, ..., x_n, y)$, $\dfrac{dy}{dx_i} = -\dfrac{f_{x_i}}{f_y}$.

4. **Elasticity of demand**

   $$\varepsilon_d = -\left.\frac{dq}{dp}\right|_{(q,p)} \cdot \frac{p}{q}$$

5. **Consumers' Surplus (CS) and Producers' Surplus (PS)**

   $$CS = \int_0^{\bar{x}} D(x)\, dx - \bar{p}\bar{x}$$

   $$PS = \bar{p}\bar{x} - \int_0^{\bar{x}} S(x)\, dx$$

   where $\bar{p}$ is the unit market price, $\bar{x}$ is the quantity sold, D is the demand function and S is the supply function.